

CLAIMS

- 1 1. In a service-provider network comprising a plurality of interconnected provider
2 edge routers and transit routers, a router comprising circuitry that:
- 3 A) receives from a source not in the service-provider network packets that in-
4 clude destination-address fields that specify final destinations that also are
5 not located in the service-provider network;
- 6 B) for each of a plurality of such received packets:
- 7 i) makes a routing decision based not only on the contents of that
8 packet's destination-address field but also on the source from
9 which it receives that packet;
- 10 ii) inserts into the packet an internal-routing field, determined at least
11 in part in accordance with the source from which the edge router
12 received the packet, that specifies a route to an interface on another
13 of the provider edge routers; and
- 14 iii) forwards the resultant packet to another router in the service-
15 provider network in accordance with the routing decision; and
- 16 C) receives, from other routers in the service- provider network, packets that
17 include internal-routing fields and destination-address fields and:
- 18 i) forwards some such packets without their internal-routing fields to
19 routers, not located in the service-provider network, that it selects
20 in accordance with a routing decision based on the contents of the
21 packets' internal-routing fields; and
- 22 ii) for other such packets, makes routing decisions based on the con-
23 tents of those packets' internal-routing fields without reference to
24 those of their destination-address fields, and, in accordance with
25 those routing decisions, forwards those packets to other routers in
26 the service-provider network.

- 1 2. A router as defined in claim 1 that:
- 2 A) makes routing decisions based on the contents of reachability messages
- 3 that it receives;
- 4 B) is connected to at least first and second pluralities of customer routers,
- 5 with which it respectively associates first and second VPN IDs;
- 6 C) when it receives a reachability message concerning a given network-
- 7 address range from a customer router with which it associates a given
- 8 VPN ID, sends a reachability message concerning the combination of that
- 9 network-address range and the given VPN ID to each router in the service-
- 10 provider network that is connected to a customer router associates with the
- 11 same VPN ID; and
- 12 D) when it receives a reachability message concerning the combination of a
- 13 network-address range and a given VPN ID associated with a customer
- 14 router to which it is connected, it sends that customer router a reachability
- 15 message concerning that network-address range.

- 1 3. A router as defined in claim 2 that uses an external gateway protocol to send other
- 2 routers in the service-provider network the reachability message concerning the combi-
- 3 nation of network-address range and the given VPN ID.

- 1 4. A router as defined in claim 3 wherein the external gateway protocol that the
- 2 router uses to send other routers in the service-provider network the reachability message
- 3 concerning the combination of network-address range and the given VPN ID is the Bor-
- 4 der Gateway Protocol.

- 1 5. A router as defined in claim 2 wherein:
- 2 A) the internal-routing field includes both an egress-router field and an
- 3 egress-channel field;
- 4 B) the router bases its routing decisions concerning the packets that it for-
- 5 wards without reference to their destination-address fields on the internal-

6 routing fields' egress-router fields without reference to their egress-
7 channel fields; and
8 C) the router bases its selections of the routers not located in the service-
9 provider network to which it forwards packets containing internal-routing
10 fields on the internal-routing fields' egress-channel fields.

1 6. A router as defined in claim 5 that maintains an information base that associates
2 internal-routing-field contents with routers to which it is connected in the service-
3 provider network and forwards packets containing internal-routing fields to the routers
4 with which the information base associates the contents of those internal-routing fields.

1 7. A router as defined in claim 6 wherein:
2 A) the information base associates at least certain internal-routing-field con-
3 tents with replacement internal-routing-field contents, and
4 B) the router replaces the certain internal-routing-field contents with the re-
5 placement internal-routing-field contents in packets that it forwards.

1 8. A router as defined in claim 7 that replaces internal-routing-field contents re-
2 places the contents of some packets' egress-router fields without replacing the contents of
3 their egress-channel fields.

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